JUNE, MDCCCLIX.

THE ZOOLOGIST:

A

POPULAR MONTHLY MAGAZINE

OF

NATURAL HISTORY

AND

JOURNAL FOR RECORDING FACTS & ANECDOTES

RELATING TO

QUADRUPEDS, BIRDS, REPTILES, FISHES, ANNELIDES,
INSECTS, WORMS, ZOOPHYTES, &c.

THEIR HABITS, FOOD, RETREATS, OCCASIONAL APPEARANCE,
MIGRATIONS, NESTS AND YOUNG.

No. CCIV.

LONDON·
JOHN VAN VOORST, PATERNOSTER ROW.

Price ONE SHILLING.

and dark-coloured, and the whole insect has the appearance of an elongated wire-worm. He had received it from Mr. Mitford, who had found it to be carnivorous feeding on the pupæ of Aleucis pictaria. It has also been found to have destroyed several pupæ of the Sphinx Ligustri. No previous indication of its carnivorous habits had been recorded nor had the peculiar structure of the abdominal segments been previously described.

Mr. Westwood also exhibited three species of insects recently received by him from Mr. Neitner at Ramboddo, in Ceylon, which have been found by that gentleman to be injurious to the coffee plantations. These consist of a species of Coccidæ (*Lecanium Coffeæ*) the scales of which infest the leaves in immense numbers; a minute moth, which Mr. Stainton thinks is referrible to the genus Gracilaria, and distinct from the Elachista coffeella of Guérin, which appears to belong to the genus Bucculatrix; the larvæ of this little moth mine the leaves of the coffee, as do also the larvæ of the third insect, a minute species of Muscidæ, which Mr. Haliday, to whom it had been referred, regards as belonging to the genus Agromyza.

Mr. Westwood also exhibited various insects which had been found to be injurious to books, in the Bodleian Library, where a careful hunt after book-worms is now going on. In addition to small cockroaches and Lepismæ (generally dead and crushed) two, if not three species of Anobium (A. striatum and A. paniceum), and their larvæ were more commonly found; the latter gnawing the interior of the bindings as well as perforating the leaves. He considered that the larvæ might be destroyed by placing the infected volumes in a large close box in which a small quantity of benzine collas had been dropped.

He also exhibited an insect which he had received some time previously from Mr. Backhouse, of Gateshead, as a gigantic flea, and which he had exhibited to the Society on the 4th of May, 1857 (without, however, having previously had an opportunity of carefully examining it), and for which he then suggested the name of Pulex Imperator. He had, however, recently examined the insect more minutely, and had ascertained that it was a very young larva of a Blatta, much distorted by being crushed flat in rather an oblique position, and with most of the limbs broken off. A small portion of the base of one of the multiannular antennæ was visible in such a situation as to seem like a part of the mouth, but on microscopically examining it, as well as the portions of the legs still remaining, it became evident that the insect was not a flea, and on dissecting the mouth, its true character was at once detected.

Captain Cox exhibited some beautiful drawings of the larvæ of Lepidoptera, including those of Carcocapsa saltatans, *Westw.*, Phlogophora empyrea, Nyssia hispidaria, &c.

Mr. Stevens exhibited, on behalf of Signor De Tivoli, some larvæ of Lepidoptera, spiders and other insects, preserved by having been immersed in a chemical solution which had the effect of hardening them; in some instances the form and colour were well preserved.

Mr. Gorham exhibited a specimen of Tachyusa concolor, recently found by him at Chelsea Waterworks.

Mr. Janson called attention to the recently published Catalogue of European Coleoptera, by Dr. Schaum, in which were many modifications and alterations, amongst which he might mention the Strepsiptera being included in it as a family of Coleoptera.

BRITISH MUSEUM

Mr. Adam White mentioned that he had just received an interesting letter from Mr. Gloyne, now a student in Geneva. Mr. Gloyne had been making excursions in the neighbourhood of that Swiss city, and was struck with the occurrence of species of Coleoptera not met with in Great Britain, but associated with species of common occurrence in our islands. He had not himself taken Omophron limbatum, but a friend of Mr. Gloyne's found that curious geodephagous beetle in banks, by pouring water on them here and there, when little groups of eight or ten individuals were sometimes met with.

Mr. Adam White remarked that he was glad to see in Dr. Schaum's new 'Catalogue of the European Coleoptera,' that the learned chief compiler of that Catalogue had separated the Brenthidæ from the Curculionidæ, and placed them close to the Longicorn Beetles.

Mr. White added that he had, some time back, tried to show at a Meeting of the Linnean Society, where he had exhibited the specimen of the rare Hypocephalus Desmarestii, belonging to J. Aspinall Turner, Esq., M.P., that Hypocephalus belonged to the Longicorns, and was close to Dorysthenes. He had then dwelt on the Brenthidæ not being far removed from the Longicorns; some, such as the great Eutrachelus Temminckii of Java, showing this affinity most markedly. He alluded to Mr. Curtis's paper on that insect, with its fine drawing. Mr. White expressed himself pleased that in a Catalogue like Schaum's, philosophical arrangement, founded on an extensive study of the Coleoptera of all countries, had led Dr. Schaum to place Amorphocephalus, the solitary European representative of the Brenthidæ, just before the Longicorns.

The Secretary read a letter from L. Lardner, Esq., accompanying some living larvæ, apparently of a species of Curculio, from Calcutta, feeding on poppy seeds, received from Sir Jamsetjee Jejeebhoy.

Mr. Stevens read the following extract from a letter just received, addressed to him by Mr. A. R. Wallace, dated Batchian, Moluccas, October 29th, 1858:—

"As there is now a boat going which may just catch the mail at Ternate, I write a few lines to let you know of my having arrived here safe and commenced operations. I came here in a small hired boat with my own men, luckily it was fine weather, or 100 miles at sea with no means of cooking and only room for one day's water, would have been more than unpleasant. I stopped five days at the Kaiod Islands, just half way, and got a nice collection of beetles, a fair number of new species, and some curious varieties of those before found at Ternate and Gilolo. I have only been here five days, but from what I have already done, and the nature of the country, I am inclined to think it may prove one of the best localities I have yet visited; I have already twenty species of Longicorns new to me, nothing very grand, but many pretty and very interesting; the most remarkable is one of the Bornean genus, Triammatus, also several species of the elegant little genus Serixia, which have been very scarce or absent since I left Sarawak; I have also an elegant new Pachyrhynchus, a fine Ips, a small new Cicindela, and a small new species of Therates. In butterflies I have taken an imperfect specimen of a glorious new species very like Papilio Ulysses, but distinct, and even handsomer! I have also seen a female of a grand new Ornithoptera, but cannot say what the male will prove to be. I have several times seen what I think is a new species allied to Papilio Codrus, but they are too wild to catch: the

Papilio allied to P. Sarpedon, which I found at Macassar, is also here, and two or three other species which I have not yet been able to capture."

Part I. of the fifth volume of the new series of the Society's 'Transactions' was announced as published.—*E. S.*

Notice of the Various Species of Bovine Animals. By the Editor of the 'Indian Field.'

(Continued from p. 6421.)

The excessive vagueness of most notices of wild or little known cattle is extremely perplexing to the naturalist, who would endeavour to make some meaning out of them. Thus it is difficult to comprehend what animal can be meant by the "gyall" of Bishop Heber's 'Journal,' briefly noticed, and very rudely figured as having been seen by that prelate in the Governor's park in Ceylon; and equally difficult is it to understand what the following passage alludes to, in Mrs. Graham's work :—At the Governor's house in Ceylon, this lady "saw, feeding by himself, an animal no less beautiful than terrible—the wild bull, whose milk-white hide is adorned with a black flowing mane!" Can there be such a creature?

"In the 'Journal of the Asiatic Society,' vol. xvi., p. 706, Mr. B. H. Hodgson thus notifies the gaour—"Bos Gaurus, *vel ?* cavifrons. The Gaur or Gauri gau. Cæsar's wild bull of Europe [the urus!], and Aristotle's of Persia, are two other species of Bibos or of Gavœus, which, could we test them, might be respectively called 'classicus et Aristotelis.' [The urus is surely sufficiently made out!] The gaurs," he adds, "inhabit the primitive forests of India generally, under the great ranges of mountains, such as the sub-Himalayas, the Vindhias, the Sathpuras, the Ghats eastern and western, and their links with the Vindhias, and with the Nilgiris. Beyond the Brahmaputra Bibos is replaced by Gavœus [quite a mistake, even if the types could be accepted as sufficiently different, in which case the banteng must needs be acknowledged as a third type, about as well marked as either of the others, or at least it certainly cannot be ranged with one rather than with the other!], of which there would seem to be two species in the Indo-Chinese countries, one of them extending to Ceylon, if the Lanka wild ox be not rather a Bibos; I suspect," continues Mr. Hodgson, "there will prove to be at least two species of Bibos, as of Rusa, inhabitants of India, between the Cape (Comorin) and the sub-Himalayas, or B. Gaurus and B. cavifrons."

We respectfully submit that the gaour is one and the same species, without appreciable difference, alike in northern and southern India, formerly in Ceylon, and still numerous in the Burmese countries and Malayan peninsula; also that nearly throughout this great range of territory there is only one species of Rusa or Sambur deer, however individuals may vary.* The gaour is the only existing indigenous wild taurine in cis-Brahmaputran India; for it is very doubtful if the wild humped cattle be indigenous to this country. The humped may yet prove to be the proper African type of taurines.

Of his genus Gavœus, as apart from Bibos, Mr. Hodgson remarks—"The Gavi or Gabi—habitat trans-Brahmaputran, the forests under the ranges extending from Asam to the sea. The Senbar vel P'hain may probably be a second species; and B. sondaicus, or the banteng, a third and the insular species; but these want testing. The first is more than half reduced from the wild state, like the yak of Tibet. The others are entirely wild."

Not so: we credit Mr. Barbe's statement, founded on personal observation, that the gaour, in addition to the gayal, is domesticated in the interior of the Tippera Hills; and we have long known that the banteng was partially domesticated in the Archipelago. The Rev. J. Mason also remarks of this animal (as we believe, in the Tenasserim provinces), that "occasionally a young wild ox is domesticated, and brought under the yoke." We identify, with scarcely a trace of hesitation, upon the strength of the evidence now before us, the T'sain or T'soing of Burma with the banteng of the Archipelago; thus reducing the number of known flat-horned taurines to three, all of which (we have much reason to conclude) are found together, or within the same district, in the Indo-Chinese region, if not also in the Malayan peninsula. What the Sumatran domestic cattle, observed and insufficiently described by Sir Stamford Raffles, may be, remains still to be ascertained.

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* The Sambur of the Malayan peninsula, Sumatra and Borneo, or Rusa equina, would appear to be a smaller and lighter-built species, with longer and finer limbs, than that of all India, R. Aristotelis; the horns also being proportionally thicker, but less elongated. That of Java, R. hippelaphus apud Gray, is very distinct, and has invariably the inner prong of the terminal fork of each horn much longer than the outer prong, being the reverse of what occurs in the spotted Axis. The Javanese Rusa is also smaller than the Malayan; but the difference of size, as represented by Dr. S. Müller's figures of skulls (drawn on the same scale), is conspicuously much less than the difference of size of fine adult skulls from India and Java now under examination. How far northward the R. equina extends, we have been unable to ascertain; but R. Aristotelis is certainly that inhabiting Arakan. The Javanese species has long been naturalised in the Mauritius.

A further notice of the gaour may yet be quoted from the pen of Mr. Hodgson:—"The gaurs rut in winter and procreate in autumn, producing usually but one young at a birth. The period of gestation was in Nepaul always stated to me to exceed that of the common ox; but Mr. Elliot will not allow this.* The herds are ordinarily rather numerous, twenty, thirty, forty, and sometimes even double these numbers, being found together; but in the breeding-season, not above ten or fifteen cows, with a single mature vigorous bull, who jealously expels every young and old male from his harem. The sub-Himalayan species entirely avoids the open tarai on the one hand, and the hills on the other, adhering to the most solitary parts of the sal-forest, close to and between the salient spurs of the hills, where the periodical firing of the under-growth of the forest never reaches. In the Dukhun these animals are said to penetrate into the hills in the hot weather—very partially, I fancy, or else they must then lack cover on the plain, for they are not a mountain race at all. They feed early and late in the more open glades of the forest, posting sentinels the while, and manifesting in their whole demeanour a degree of shyness unparalleled among the bovines [unless by B. sondaicus]. They never venture, even in the rains, when there is abundance of most rank vegetation to cover their approaches, into the open tarai to depredate on the crops, as the wild buffaloes constantly do; nor do they ever associate or interbreed with the tame cattle, though immense numbers of the latter every spring are driven into their retreats to feed, and remain there in a half-wild condition for three or four months, when the wild buffaloes frequently interbreed with the tame ones of their kind, of which, likewise, vast numbers are depastured there. Old males of the gaur are often found solitarily wandering the forests they frequent, especially in winter; but these have probably been recently expelled the herds by their more vigorous juniors, and re-unite themselves with some herd after the season of contention has passed. It is exceedingly difficult to rear the Gauri Gau in confinement: nor did I ever know a successful experiment, though the attempt has been, for fifty years past, constantly made by the Court of Nepaul, which finds no difficulty in rearing wild buffaloes and causing them to breed in confinement with the domestic species, which is thus greatly improved in size and other qualities.

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* There would seem to be some mistake about the excessively slow breeding of the gayal, one calf in three years only!

I have remarked on the excessive shyness of the gaurs; and it follows that, when approached, they will retreat so long as they can; but if compelled to stand and defend themselves, they do so with a courage and determination not to be surpassed. Their beef is unequalled for flavour and tenderness [we have been told this likewise of the banteng]; but to the aborigines only it is illicit food, and not to all tribes of them, nor are any of them allowed to kill the gaur in Hindu kingdoms. The gaur stands from 6 to 6½ feet high at the shoulder, and is either of a ruddy brown *alias* tan, or of a black colour, the forehead and limbs below the mid-flexures being pale, and the forehead and knees [moderately] tufted. Captain Tickell, a good observer, believes that there are two species of Bibos in the Chota Nagpore territories alone! Doubtless close investigation will reveal many new species in the Bovinæ.

Not any more in cis-Brahmaputran India, we suspect; and we regard the identification of the continental Tsoing with the insular banteng as an important step gained. Strange indeed that such a question, referring to animals of such magnitude and interest to the sportsman, should not long ago have been settled, as all such questions require to be, by actual comparison of specimens; and still more strange that educated sporting gentlemen should feel so little interest in their decision,—that twenty years should have elapsed since Helfer, for example, called attention to the different species of bovines that inhabit the Tenasserim provinces, and that even yet they are not determined—the gayal for instance—with absolute certainty, and the banteng only now with a very near approach to certainty! Let us hope that these notices will awaken some attention to the subject.

The third primary division of the bovine animals is the bubaline, or that of the buffaloes, properly so called. We have treated of the bisontine, which comprises—*first*, Ovibos, or the musk cattle of Arctic regions; *secondly*, Bootherium, extinct; *thirdly*, Bison, the true shaggy bison of the north temperate zone; and *fourthly*, Poephagus, or the yak of high Central Asia. Also of the taurine, in which we recognise three principal types,—*first*, Bos or Taurus, exemplified by the domestic cattle of Europe and Northern Asia; *secondly*, Zebus, or the humped cattle of the tropical regions of the anciently known continents; and, *thirdly*, Gavœus, or the flat-horned group peculiar to tropical and juxta-tropical Asia. We now arrive at the bubaline series, or that of the true buffaloes.

These animals are peculiar to the warmer regions of the eastern hemisphere, and are at once recognised and distinguished from other bovines by their hog-like aspect and wallowing habits,* and their relative thick and thinly clad hide, the hairs of which are inserted vertically; in short by their pachydermatous exterior, superadded to the ordinary characters of the group. Their horns are flattened and mostly directed downwards and outwards, with a greater or less inclination backwards, then uncinating or gradually curving upwards to the extremity. They carry the nose horizontally, being much guided by the sense of smell; and it is a position in which they pass hours in the water, having little more than the nostrils above the surface. Their proportions are heavy, indicative of this aquatic propensity. Though inhabitants of hot climates, no animal is more impatient of heat; and nothing can prevent the domesticated races from plunging or wallowing whensoever an opportunity offers, at least when weary or over-heated, —which of course unfits them for being laden with any article to which moisture is injurious. They float, and commonly sleep in the water, and cross the broadest rivers with little effort; the females, when danger from crocodiles or other foes may be apprehended (like hippopotami), carrying their young upon the back.† They can also run swiftly up to their bellies in the stream. Hills are naturally avoided by them (albeit they thrive in hilly districts), though they scramble up steep acclivities with surprising ease, where horses cannot follow; and they prefer the coarse plants of the forest, and such as grow in swampy districts, to those of open plains. It is even stated that during the inundations of the great tropical rivers these animals frequently dive, and employ their horns to draw aquatic plants to the surface, where they feed on them, while drifting with the stream.‡ Their habits are, for the most part, gregarious (as with the bovines generally), the leader of a herd expelling the younger males as they acquire prowess to cope with him; and such banished individuals (like *san* elephants, &c.), are particularly savage and dangerous to encounter. Their voice is a low rumbling moan. In their combats they strike and butt with the forehead (like all other bovines), endeavour to lift the opponent on their horns, and when thrown, to crush him with their knees: they trample upon the body; and their vindictive fury is so lasting that they will return again and again to glut their vengeance on the same inanimate corpse. The Cape species tosses like a common bull, as the flexure of its horns would intimate; but the long-horned Indian buffaloes attack a man or tiger by goring, which, notwithstanding the backward curvature of their horns, they effect by bringing the head close under the breast (much in the manner of an oryx), and charging with the point of one horn directed forwards and almost touching the ground; the action is, however, the same in both cases. "Upon an attack or alarm," writes Marsden, "these animals flee to a short distance, and then suddenly face about and draw up in battle array, with surprising quickness and regularity; their horns being laid back, and their muzzles projecting. Upon the nearer approach of the danger that threatens them, they make a second flight, and again halt and form; and this excellent mode of retreat they continue till they have gained a neighbouring wood." They manifest the same antipathy to glaring colours, and particularly red, as the rest of the group, and likewise as the gnus (*Catoblepas*), of which sundry anecdotes have been recorded; but, as in other cattle, habituation to the sight of such colours renders them indifferent to them, as Sonnini remarked of the domestic buffaloes of Egypt, where the inhabitants, besides their red turban, wear also (in general) a shawl of the same colour enveloping the neck and chest. The flesh of buffaloes is extremely coarse and cellular, like that of the elephant, rarely fat, and of rank unpleasant flavour; but the milk of the female, though not so sweet as that of the cow, is good, and given in great quantity:* the hide, also, is very substantial, and, when well tanned, proves equal to every purpose to which stout leather is applied. Lichtenstein remarks, of the Cape species, that its ribs are extraordinarily broad, leaving scarcely any intervals between them; which is perhaps a character of the buffaloes generally, though something very like it may be seen in ordinary "ribs of beef." The young (both of the African and Asiatic species) are born of a whitish colour, which is succeeded by yellowish buff hair, when the animal is a third grown. Those of Asia and Africa form two natural sub-divisions; the horns of the Asiatic being more widely separated at base, though the Bubalus brachyceros of middle Africa is intermediate in this respect. The African have also rounder ears, which in B. brachyceros are extraordinarily large; the Asiatic buffaloes having a more lanceolate form of ear,—like the humped taurine cattle, as opposed to the European type of taurines. So far as known, all bubalines have, normally, thirteen pairs only of ribs, like the taurines; not fourteen or fifteen pairs, as normally (so far as known) in the bisontines.

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* The American bison, however, is a good deal of a wallower.—*Vide* Catlin's work and its illustrations.

† Marsden's 'History of Sumatra,' p. 95.

‡ Pennant's 'Hindustan,' vol. i. p. 115.

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* Mr. Paget, in his work on Hungary and Transylvania (vol ii. p. 227), states that it is richer than that of the cow; but we suspect the quality varies much in the different races. Buffalo's milk is, indeed, particularly esteemed in the Dukhun and north-west of India.

The Indian buffalo—(*Bos Bubalus*, L.; *Bubalus buffelus*, Gray; *B. Arna*, H. Smith—at least in part; *B. speiroceros* and *B. macroceros*, Hodgson). Domestic buffaloes are so familiarly known in this country, that an elaborate description of the appearance of the animal is unnecessary. They are ungainly and clumsy-looking creatures, but useful in their way, from their great strength and fair amount of docility combined with their adaptation to marshy localities and wet and heavy soil. Emphatically, they are the beasts for tilling the ground in ordinary rice cultivation, which is mainly conducted by their aid; and they are the only domestic cattle over extensive regions of the Malayan Peninsula and Archipelago, the south of China, and much of Indo-China, and have long been introduced into Lower Egypt, Italy and Hungary, the marshy tracks bordering on the Black and Caspian Seas, and latterly on the shores of the Gulf of Carpentaria, in Northern Australia, by the Malays; and in all these different countries many have returned to wildness, not excepting in Australia. In America it does not appear that the domestic buffalo has ever been introduced, and its name is there usurped by the bison.* There is considerable difference, however, between some of the races of domestic buffaloes, and to this we shall advert in the sequel.

As an Indian animal, Mr. Hodgson thus describes the common buffalo:—"Habitat of the tame, universal; of the wild, also everywhere that adequate cover and swamp exist. The haunts of the Arna or wild buffalo are the margins rather than the interior or primeval forests. They never ascend the mountains, and adhere, like rhinoceroses, to the most swampy sites of the districts they frequent. There is no animal upon which ages of domestication have made so small an impression as upon the buffalo,† the tame species being still most clearly referrible to the wild ones at present frequenting all the great swampy jungles of India. But in those wildernesses, as in the cow-houses, a marked distinction may be observed between the long-horned and curve-horned buffaloes—or the B. macroceros and B. speiroceros of my catalogue—which, whether they be separate species or merely varieties, I shall not venture to decide, but I incline to regard them as species. The length of the horns of B. macroceros are sometimes truly enormous, or 6½ feet each.

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* A correspondent of the 'St. Louis Republican' states, in a late number, that "the Utah mail encountered myriads of 'buffaloes' feeding upon the luxuriant grasses of the plains, blocking up the highways, so as to delay it, while deer and antelopes were more numerous than ever seen before."

† We think the donkey might bear comparison.

"There is such a pair in the British Museum, and another pair I saw in Tirhoot. The Arna ruts in autumn, and the females produce one or two young in summer after a gestation of ten months. The herds are usually numerous, and sometimes exceedingly so, though at the season of love the most lusty males lead off and appropriate several females, with which they form small herds for the time. This noble species is, in the sal-forest and tarai, a truly stupendous animal, as tall as the gaour, and longer considerably, and of such power and vigour as by his charge frequently to prostrate a well-sized elephant! The wild animals are fully a third larger than the largest tame breed,* and measure from snout to vent 10½ feet, and 6 to 6½ feet high at the shoulder. The wild buffalo is remarkable for the uniform shortness of its tail, which extends not lower than the hock; for the tufts which cover his forehead and knees; and, lastly, for the great size of his horns and the uniform high condition of the animal, so unlike the leanness and angularity of the domestic buffalo's figure, even at its best."

This difference in the development of the wild and tame buffalo is equally observable where the two frequent the same pastures and commonly interbreed; and we believe the main reason of it to be, that the tame calves are deprived of their due supply of milk.† The importance of an ample supply of suitable nourishment in early life, as bearing on the future development of any animal, cannot be over-estimated. It occasionally happens, during great inundations, that many wild buffalo-calves are noosed while swimming about and added to the domestic herds.

Still, it is remarkable that this swamp-frequenting animal thrives particularly in hilly districts. The domestic are particularly fine towards the sources of the Nerbudda; and Mr. Harkness, in his work on the aborigines of the Nilgiris, remarks that the tame buffaloes there are "fine large animals, monsters in comparison to those of the low country,"—and again, "the buffalo of the Nilgiris is of a much better description than that of the low country, and the milk they yield is of a flavour and richness superior to any of the kind I have met with. The climate seems better adapted to them than that of the plains. They are not tormented by the innumerable flies and other insects that in the latter force them to plunge into water, or, as the case may be, into some muddy pool, remaining there for the greater part of the day with just their foreheads and nostrils above the surface; but here they quietly range over the downs, in herds often from 100 or 150 to 200, unmolested and unannoyed, feeding on a rich and luxuriant herbage, more adapted to their taste than the finer kinds of grass." Few sights surprise a novice more in India than to see a herd of these huge brutes emerge from a small muddy tank, where the presence of so many great animals was previously unsuspected.

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* In like manner, the sub-fossil urus is fully one-third larger than the largest breeds of domestic taurines of the same type. This remarkable analogy of the wild and tame buffalos should be borne in mind.

† Since the above was in type, a friend who has just returned from Maulmein has confirmed us in this opinion. He remarks that he never had an idea of what a fine buffalo was, till he saw those of Burma. They are there much larger than in Bengal, with splendid horns, and altogether a vastly superior animal,—in fact, resembling the wild buffalo. The Burmese never milk them; having the same strange prejudice to milk which the Chinese have, though otherwise both people are nearly omnivorous.

In western Malasia generally, and especially in Sumatra, as about Bencoolen, albino buffaloes are very prevalent, having the same disagreeable leprous look as the white elephant. Those of the Philippines and China are uniformly small, but robust, and this seems to be the race figured by Dr. Salomon Müller.* They are finer, however, towards the north, as in the Chusan Archipelago.* Those of Lower Egypt are quite similar to the ordinary tame buffaloes of Lower Bengal; and Ruppel remarks that they are now found also in the wild state in the marshes of the Egyptian Delta, where termed Gamus. We have remarked that they have likewise gone wild on the north coast of Australia, where introduced by the Malays.† Chesney tells us that they are found in a wild state towards the shores of the Black Sea. The tame are numerous in Armenia, Persia, Kerdistan, Mesopotamia, and in all suitable districts of Arabia; in which last-named peninsula Chesney remarks that—"Next to the camels, in point of number, are buffaloes, which are to be found in most places where water is abundant [no prevalent feature of Araby the Unblest!]; their milk is rich and tolerably good, although inferior to that of the goat or cow."‡ From these countries they spread westward as far as Hungary and the valley of the Nile; and are now also on the island of Zanzibar, on the east coast of Africa.[*] Those of Circassia, as we were informed by the late J. Stanislaus Bell, "agree with the Italian in their highly-bombed forehead and ponderous conformation, as also in the abundance of excellent milk afforded by the cow (often for two years, as I was assured); but the horns—especially those of the female—are very long, incline backwards, and are much curved, annulated and serrated: attitude that of the Indian buffalo; the tail with its terminal tuft not reaching above half-way to the ground. The young are of a dusky brown; but the full-grown are almost invariably black, without a single spot of white; and their stature exceeds considerably that of the largest European [taurine] cattle." We recognise in this description an animal similar to the tame buffalo of the Nilgiris.

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* Tame buffaloes seem to be co-extensive in range with the Malayan race of mankind in the Archipelago; but we do not hear of that race having transported them to Madagascar. There is much rice cultivation, however, in that island, where the ground would appear to be tilled by a superior race of the humped cattle. With regard to the humpless wild race of cattle in Madagascar, hitherto undescribed, it seems that these animals are very numerous in the province of Mena-bé, which occupies much of the western portion of the island. In Mr. J. A. Lloyd's 'Memoir on Madagascar,' published in the 20th volume of the 'Royal Geographical Society's Journal,' we read (p. 63) that "the northern part of Mena-bé contains great numbers of wild cattle. Radama and his officers, in one of their warlike expeditions amongst the Sakalami, passing through this country, killed upwards of 340 oxen in one day for the use of his army, and two days afterwards 431 more were killed by the soldiers." All that we can as yet learn of this race (or probably species) is, that it is humpless, and with longer limbs than the cattle of Europe.

There are "wild cattle" of some sort in Albania! (*Vide* Count Karaczsay's "Geographical Account of Albania," published in the 'Royal Geographical Society's Journal,' vol. xii. p. 57). Are these bisons, or a primitive taurine stock, or tame cattle gone wild?

We have not thought it worth while to note down every locality where European cattle have returned to wildness; as in the Sandwich Islands, where poor Douglas, the botanical collector, met his fate in a pit-fall with a wild bull, and even in Rodriguez!—*Vide* 'Journal Royal Geographical Society,' vol. xix. p. 19.

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* "In its productions, Chusan does not materially differ from the adjacent mainland of Ning-po. The sleek and small cattle and the buffaloes, larger than those in the South, are used exclusively for the plough, and never slaughtered for the use of the Chinese, so near to the head-quarters of Budhism in the neighbouring island of Pooto."—Sir J. F. Davis, in 'Journal Royal Geographical Society,' vol. xxiii. p. 248.

"In Kambodia the buffalo lives amongst mud and ditches, and is a very powerful animal: further north its fierceness much decreases. The bullock is of a very small breed."—Gutzlaff, in 'Journal Royal Geographical Society,' vol. xix. p. 104. Here "all that comes from the cow is held in abhorrence!"

† Dr. Leichardt, in 1845, remarked that buffaloes were "very numerous at Baki-Baki's Creek, which joins Mountnorris Bay. They are equally abundant between Raffles Bay and the harbour: the whole country, particularly round Baki-Baki's Bay, and on the neck, being as closely covered with buffalo-tracks as a well-stocked cattle-run of New South Wales could be."—'Journal Royal Geographical Society,' vol. xvi. p. 237.

‡ It may here be remarked that the humped cattle of Arabia generally are "of a very small and poor race, and are never, but with the greatest reluctance, killed for food." (Wallin, in 'Journal Royal Geographical Society,' vol. xxiv. p. 148). Chesney remarks of them, that "bulls and cows take the next place to the buffalo, and like those of India, they bear a hump, and are of small size; some bullocks purchased at Suweideyah, produced each only about 224 pounds of meat." Again, in his 'Appendix' (vol. i. p. 279), he enumerates, among the domestic animals of Arabia and Mesopotamia, "both the common bull and cow, and the bull and cow with hunch." In the province of Kerman, in Persia, Mr. Keith C. Abbott remarks that "the oxen in this part of the country are of a small humped kind, and are commonly used as beasts of burden; people also ride on them, seated on a soft pad, and a rope is passed through the nostril, by which they are guided."—'Journal Royal Geographical Society,' vol. xxv. p. 43.

According to a writer in the 'Bengal Sporting Magazine,' "there is a wide difference observable between the buffaloes in and about Behar, and those found near Titiláya: the former have invariably very thick but short horns, the latter (as invariably) remarkably large spreading ones;" and another writer in the same work pourtrays the horns of the wild buffalo of Asám, as contrasted with that of the Sunderbans.[†] These races are the B. macroceros and B. speiroceros of Mr. Hodgson. In the former the horns proceed out almost straightly, with a somewhat abrupt hook inward towards the end; in the latter they curve uniformly throughout, or very nearly so, to form a flat semicircle, with the usual slight tendency backward at the extreme tip. The horns of the fossil buffalo of the Nerbudda deposits (*Bos palæindicus* of Cautley and Falconer) have again another flexure, inclining backwards, outwards, and somewhat upwards, in a sweeping curve. In all, the cow-horns are more slender, and not unfrequently much longer, than in the bull.[*]

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[*] "Bullocks, cows, and water-buffaloes are to be had at Zanzibar, but are seldom or never killed for food; they are used to carry loads (but not for draught), and are as dear as 50 dollars each."—'Journal Royal Geographical Society,' vol. xxiii. p. 107.

[†] 'Bengal Sporting Magazine' for September, 1836, p. 203, and *ibid*. October, p. 231.

[‡] Of abnormal horns of the Indian buffalo, we have a drawing of a pair of cow-horns (attached to the skull) from Southern India, the flexure of which is nearly that proper to the horns of the Caffrarian taurine cattle, with the tips pointing outwards! Distance apart from tip to tip 9 feet 5 inches.

The late Mr. R. W. G. Frith, who was a very close observer, considered that there are "two races of wild buffaloes in India, both of which are likewise found domesticated. One, the Kachar bhainse, is distinguished by its greater height, having longer limbs, by the general absence of hair at all seasons, and by its longer and slighter horns, which vary in form considerably more than those of the other. The

The Italian buffalo is a very different-looking beast from that of India, at least from the ordinary tame buffalo of Bengal. His carriage is different—less emphatically bubaline; he is better clad, and has a remarkably convex or bombed forehead, and short horns, that curve much down, then out and up, with the usual slant backward, which, however, is but slight. The tail, too, with its tuft, descends quite to the fetlocks. He is commonly more or less splashed with white; but this we have observed of many Indian buffaloes, especially in Oude.* If our information can be relied upon, the same race is found in Sindh. Hornless individuals occur sometimes; and skulls of this race, both horned and hornless, are figured in the 'Ossemens Fossiles' of Cuvier. The buffalo is stated to have been introduced into Lombardy from India by King Agilulf, who reigned from 591 to 616,* and has now gone wild, as usual, in the Pontine marshes. It was first described as the "Arachosian ox" by Aristotle; the site of the ancient city of Arachosia being near the modern Kandahar, as determined by Rawlinson in 1841.

The Anoa buffalo—(*Bubalus depressicornis; Anoa depressicornis*, C. H. Smith). This is a very curious little animal, from the mountains of Celebes, of which there is now a stuffed specimen in the British Museum; but we are unaware that aught has been added to its history since the time of Pennant! We have seen several frontlets, and one entire skull (minus the lower jaw), of which we possess drawings. Pennant remarks, in his 'History of Quadrupeds,' that the Anoa is a

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calf, however, is densely clad with slaty white hair, having constantly a medial white mark on the fore neck and chest, crossed by another on the fore part of the neck. This is the more valuable of the two to the herdsmen, on account of its giving more milk. The other stands lower on the legs, is altogether a thicker-made animal, and much more hairy; the horns are much thicker, and very rugous or deeply furrowed in the males; the calf has no white cross on the breast, and is of a more rufous colour than that of the other. This race is called the Bhángar. Both occur in the same herd, but the former are less numerous; and they breed freely together, the offspring of the first, second and third crosses being readily distinguished by the herdsmen; nevertheless, characteristic specimens of both are generally to be found in every herd." We should be glad if any reader could verify and further carry out these observations.

* Black, white and pied, or rather black splashed with white. We have seen no intermediate shades of coloring, except in the calf.

† "Tunc primum caballi sylvatici et Bubali in Italiâ delatis, Italiæ populis miraculo fuerunt."—Warnefridi, 'De gestis Longobardorum,' Lib., vol. iv. c. 2; Misson's 'Voyage,' vol. iv. p. 395, as quoted by Pennant.

very small species of buffalo, of the size of a middling sheep. They are wild in small herds, in the mountains of Celebes, which are full of caverns. They are taken with great difficulty, and even in confinement are so fierce that Mr. Soten lost in one night fourteen stags [*Rusa ?* ——— ?], which were kept in the same paddock, whose bellies they ripped up."

In an excellent treatise on the generic sub-division of the hollow-horned ruminants, by R. N. Turner, jun., published in the 'Proceedings of the Zoological Society' for 1851, it is remarked that—"Although Colonel C. H. Smith was deceived as to the affinities of the Anoa, later as well as earlier naturalists have assigned it to its true place, and a glance at the stuffed specimen in the British Museum leaves the matter beyond a doubt. I have examined the skull in the Museum of the Royal College of Surgeons, and cannot see that it has even a title to generic distinction. Naturalists seem at all times to have been prone to assign generic rank to whatever was mysterious or difficult to classify, and I can in no other way account for this species being made a genus."

Mr. Turner does not carry the sub-division of the bovines beyond Bison, Bos and Bubalus; but he admits Ovibos, and remarks of it:—"This animal, which derives its name from its general aspect being intermediate to that of the ox and that of the sheep, has generally been placed among the bovine forms. Taking the aggregate of its characters it appears to me to be at least as nearly, if not more, allied to the sheep, but should most properly stand alone." To us it appears to be immediately connected with the bisons by the intervention of the fossil genus Bootherium. Mr. Hodgson, on the contrary, would separate the African buffaloes from the Indian; admitting which separation, the Anoa should be likewise so distinguished.*

The Anoa has straight, flat, bubaline horns, continued back nearly in a line with the forehead, as in the Cape or Abyssinian oryx, or as in the eland; they are shorter than the head, smooth, and very sharp-pointed, and are depressed below the plane of the visage; they scarcely diverge in their exterior outline, but sharpen off from about the middle in their interior outline.* In our drawings, made carefully on the scale of an inch to a foot, the total length of skull, from vertex to tips of intermaxillaries, should be 13½ inches; greatest breadth posterior to orbits, 6 inches; length of horns, 9 inches; width apart at base, 1½ inch; at tips 4½ inches; width apart at base, measuring from the outside, about 4¾ inches. The dagger-like shape of the horns indicates them to be extremely formidable weapons. We can hardly think that this very small animal can be the "wild cow" of Celebes. It is the Bos bubalus, var. B, of Pennant; and some other species, unknown to modern science, he has certainly indicated by his var. A, which he has very rudely figured, and describes as follows:—

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* Of the Budorcas taxicolor of Mr. Hodgson, Mr. Turner remarks that "a glance at the representations of the skull indicates very plainly that it is closely allied to Næmorhedus [in which we think he is altogether wrong in associating the goral with the surrows], to which Mr. Hodgson admits certain resemblances, and that it has no relationship with the gnus or the musk ox." This quite coincides with our own opinion.

"Naked: a small sort, exhibited in London some years ago, under the name of Bonassus; of the size of a runt: hair on the body bristly, and very thin, so that the skin appeared; the rump and thighs quite bare, the first marked on each side with two dusky stripes; horns compressed sideways, taper, sharp at the point.—East Indies."† Can this have been one of the "wild cattle of Timor Laut," noticed by Mr. Earl, but said to have "upright horns?" Pennant's figure would seem to represent an animal nearly akin to the Anoa of Celebes, with depressed horns curving a little inwards. He represents two dark bars on the naked rump, and two others across the thigh; the neck and body anterior to the haunch being clad with longish hairs.

(To be continued.)

Buff-coloured Rabbits.—In a former number of the 'Zoologist' I sent some account of several varieties of white and variegated birds, pheasants, blackbirds, and a thrush met with here, and also of sixteen or eighteen buff or straw-coloured rabbits, which had lately appeared amongst the other common rabbits; the former being of different broods and sizes and in different covers distinct from each other, so that they could not have come from the same parents or stock, but were unquestionably bred from the common coloured rabbits in different places and of different ages, and were to be seen daily, and grew and thrived well, until within the last three or four months, when they gradually disappeared, and now there is not a single rabbit out of all the sixteen buff-coloured ones to be seen, though plenty of the common brown rabbits, both old and young, are to be seen in every direction as before. As the winter was so remarkably mild, with scarcely a day's snow and but very little frost, and as it is perfectly certain that these buff-coloured rabbits have not migrated, I am utterly at a loss to account from what cause the singular and sudden disappearance of all these buff rabbits is to be attributed to. It is impossible that the foxes or vermin can have selected them in preference to the other kinds; nor can the severity of the winter have caused their death. But from what can it have arisen? — *W. H. Slaney; Hatton Hall, near Shrewsbury, May* 6, 1859.

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* Not a few of the humped taurine cattle have straight horns, more or less resembling in direction those of the Anoa buffalo. Such are of tolerably frequent occurrence among the large ordnance bullocks of this country. That the same type prevails in Central Africa may be inferred from one or two of Dr. Barth's plates.

† The humped cattle of Algawf, it is elsewhere stated, "are, as generally in Arabia, of a very small and poor race, and are never, but with the greatest reluctance, killed for food."

Occurrence of the Golden Oriole (Oriolus galbula) *near the Land's End.*—A male specimen of the golden oriole, in its full brilliant plumage, came into my possession yesterday: it was captured in a sequestered valley about four miles westward of this place, flying from hedgerow to hedgerow, very much in the style of the missel thrush (*Turdus muscivorus*). The bird was in a state of emaciation and feebleness, but probably it had not been long so, for the whole plumage is in a state of unsullied purity. —*Edward Hearle Rodd; Penzance, May* 2, 1859.

Kite, Hoopoe and Golden Oriole shot near Scarborough.—I had the following rare birds brought in last week: — a male kite (*Falco milvus*), in fine feather, trapped near this town; a hoopoe (*Upupa epops*), and a second very beautiful specimen, shot near Oliver's Mount; a male golden oriole (*Oriolus galbula*), in the finest adult plumage, shot at Hunmanby, on Rear-Admiral Mitford's estate. — *Alfred Roberts; King Street, Scarborough, May*, 1859.

Curious Situation for a Dipper's Nest.—A curious fact in the nidification of the dipper (*Cinclus aquaticus*) having just come under my notice, a fact, so far as I am aware, quite unprecedented, I make no apology for laying the occurrence before your readers. This nest was situated at the extreme end of a sand martin's old hole, formed in a sand-bank overhanging a small brook, and nearly two feet in depth. The old bird was caught on the nest by the finder, and with some difficulty drawn out of the hole, the aperture being barely sufficient to allow the introduction of his arm. Five fresh eggs were taken from the nest, which was subsequently dug out, and a good deal resembled in shape that of the blackbird, but, as usual, was composed of moss thickly lined with oak-leaves, the dome, however, being entirely wanting. I have seen many dozens of dippers' nests, but never either saw myself or read of one built in a situation at all resembling the above, and, believing the circumstance to be unique, I have lost no time in communicating it to you. — *Henry Smurthwaite; Richmond, Yorkshire, May* 16, 1859.

Occurrence of the Hoopoe near Shrewsbury.—On the first of May a fine specimen of that rare bird, the hoopoe, was seen at Walford Manor, near Shrewsbury, the seat of R. A. Slaney, Esq., M.P. It was feeding in a turnip field near a farmhouse and outbuildings, and was very tame, running from place to place in pursuit of worms, and allowed Mr. Slaney and his brother to come within about twenty yards of it, so as to be distinctly observed. It had a pendant crest falling back, and not erected like the one described in the Plate of the hoopoe in Bewick's 'British Birds.' The white markings on the wings and body were very vivid, there seemed but little black between the white bars, but a dull fawn or reddish brown colour prevailed. After some little time the bird flew to a hedge, and there meeting with a blackbird a fight ensued, the former driving the hoopoe away, who again came and lit where it had before been feeding, and, eventually, went close to the farmhouse and buildings, and then flew off. A similar looking bird, as described by the keeper, had been seen about a month before near a small village about a mile distant, which was probably the same bird as that before mentioned. — *W. H. Slaney; Hatton Hall, near Shrewsbury, May* 6, 1859.

Occurrence of the Hoopoe near Cambridge.—The other day a labouring man informed me that he saw a gamekeeper shoot, near Foulmire, Cambridgeshire, a curious bird, at the same time asking me to show him a book on Natural History, which I willingly did; he instantly pointed me out the hoopoe (*Uupupa Epops*), which, upon seeing the bird, proved to be accurate. The same man saw, not many fields off, one of the same birds sitting upon a hedge; doubtless they were male and female; the former one when shot was feeding in a ploughed field, and, he says, was very active in its movements. I have since had one procured near Bottisham, Cambridgeshire, April 28th, 1859.—*S. P. Saville, Jun.*, 93, *Castle Street, Cambridge, May* 6, 1859.

Occurrence of the Hoopoe at Dulwich.—A female specimen of the hoopoe (*Upupa epops*) was shot in this neighbourhood by J. Willis, gardener to Mr. Barclay, of Dulwich Common, in his garden, on the 26th of last month, and brought to me for the name.—*C. Wood; May* 10, 1859.

Extraordinary Situation for a Cuckoo's Egg.—The vestry of my church is a lean-to, the roof running up under the eave of the chancel; but, as the two roofs are differently inclined, a kind of wedge-shaped space is formed by the eave and wall of the chancel and the coping of the vestry. In this space, on the coping, a pair of pied wagtails (*Motacilla alba*) last year built their nest, which when discovered contained only an unfledged cuckoo. As a projecting rafter closed this space on one side of the coping, and the distance of the eave from the coping was barely 1½ inch, there seemed no room for a cuckoo to enter; but, on examination, I found it might do so on the other side of the coping, which did not extend quite to the next projecting rafter; still it must have been a very confined and inconvenient situation for a cuckoo to deposit its egg in the ordinary way; and the question mooted in the 'Zoologist' (Zool. 1774), "Does the cuckoo carry its eggs?" may fairly be repeated.—*William Turner; Barholme Vicarage, Stainford, May* 3, 1859.

Woodcock's Nest in Norfolk. — A woodcock is at the present time sitting on four eggs in a wood in Runton, near Cromer, on the coast of Norfolk: the nest is among a very few dead ferns, in an otherwise bare spot, under some trees.—*T. Fowell Buxton; Cromer, April* 30, 1859.

Occurrence of the Little Bittern near Cardiff.—A female specimen of the little bittern (*Ardea minuta*) was run down and captured by some harriers on the moors west of this town, in February last. During its short and miserable captivity, at which period I could not gain possession of it, it was remarkably fierce, darting its beak with extraordinary activity, virulence and pertinacity at anything brought within reach. By its unamiable disposition and refusal to take food (which, however, was of an unnatural kind), it soon gained the dislike and ill will of its master, became neglected and was starved to death. The ovaries were considerably developed, but it had not assumed its fully adult plumage, if I am correct in supposing that the breast should have lost its brown markings, and that the shoulder, instead of being rusty brown, and the feathers slightly edged with buff, should in the adult be shining bluish black, as are the top, the head, occiput and tail-feathers of this specimen. Again, the back of the neck of this bird is bare, and the feathers on the base of neck in front are elongated as in the adult, but the outer web of the first quill-feather is buff-coloured, and the wing-coverts are rich deep brown.—*R. Drane; Cardiff, May* 18, 1859.

Dates of the Arrival of Migratory Birds.—The swallows appeared partially here about the 7th of April, a very hot day, but disappeared in a couple of days, as if fancying they had made a mistake, on the change of temperature, with bitter cold northeast winds; these birds reappeared on the 29th and 30th of April. I have not yet seen a swift. On the 7th of April I heard the chiffchaff. On the 24th the blackcap (*Sylvia atricapilla*) chanted his short but melodious song. On Sunday, the 1st of May, I heard the nightingale, but as it was a cold evening, with strong northeast winds, he only gave out three times "sweet jug!" and then closed; it was about 5 P.M., in a small covert near the turnpike on the Gloucester road. The cuckoo appeared and was heard first here on the 26th of April, and was not heard again until this morning, when I heard two in different directions at the same time; this day being 9° Fahr., milder than yesterday, with a fine warm sun.—*H. W. Newman; Lansdown, Cheltenham, May* 6, 1859.

Inquiry respecting a Bird's Nest.—I am rather perplexed by a nest with three eggs which was brought to me three days since. I had employed a person to get a few eggs for me, and the result of his first expedition was two nests; one, which I had no doubt about, a ring ouzel's; the other he pronounced to be a missel thrush's. I disputed the fact; but he said that he had seen the old bird fly off, and it was a "May thrush." The nest was in the fork of a stunted Scotch fir growing on the moor, was composed of coarse grass externally, twined about with dry rushes and flexible roots and longer pieces of grass; inside, lined with finer grasses, and between a walling of clay. The second nest had a good deal of ling and moss among its materials, was taken from the ground, and was twice as heavy, with clay, as the former, and altogether unlike it in colour, compactness, general neatness and finish, independently of dissimilarity of material. This, an undoubted ring ouzel's nest, contained four eggs; two of which resembled, in a degree, the missel thrush's egg, as to shade and markings; the other two might rank with Mr. Hewitson's original. They were all equally "hardsat," and I had some trouble in getting three out of the four safely blown. The eggs in the other nest were, all three, perfectly fresh, showing there had been no accidental confusion of eggs; but their markings were not at all like those of any missel thrush's eggs I have ever seen, and, besides, they were all much less than the eggs in the ring ouzel's nest, very distinctly less. Two out of the three precisely resembled, in colour and markings, the two darker ring ouzel's eggs; the other was slightly lighter in shade. My question is, what nest and eggs are these? They are not blackbirds', certainly; they are not, I feel certain, a missel thrush's; and, I think, the position of the nest, its nature and materials, preclude the idea of its being a ring ouzel's. The man who brought me them is a character in his way; very keen to accompany me on any shooting expedition; a good fisherman, and, though not of strong intellect, is a very shrewd fellow in such things as I have named, and others like them. Had the bird which flew off the nest been a blackbird or a ring ouzel, he would certainly have identified it. I think he has mistaken in pronouncing it to be a missel thrush; and my own doubt is whether or no it may not have been a redwing. There have been many more of those birds here than usual during the winter: I think I never observed half so many, or even nearly half so many, on any former occasion; and it is at least conceivable, that storm-stayed by the late continued inclement weather—bitter indeed on our moors—a pair (or more) of them have stayed to nest here. I have also met with another not very usual circumstance in relation to birds' nests this year: I observed a bird leave her nest in a hedge as I passed, rather near; on looking in I saw a blackbird's nest, but with four thrush's eggs in it—I mean that the nest was lined with fine dry grass, &c., in precise resemblance to a blackbird; the eggs, however, being such as to preclude the idea that they were laid by a bird of that species,—or any idea, save that they belonged to a thrush.

	Length.	Breadth.
1. Ring ouzel's egg	$1\frac{8}{32}$	$\frac{26}{32}$
2. Blackbird's egg	$1\frac{9}{32}$	$\frac{25}{32}$
3. Blackbird's egg out of different nest	$1\frac{4}{32}$	$\frac{28}{32}$
4. Thrush's egg	$1\frac{1}{32}$	$\frac{26}{32}$
5. Doubtful egg	$1\frac{6}{32}$	$\frac{25}{32}$

These are the comparative lengths and widths of five eggs, the last of which is the egg I am puzzled with; 2, is a long narrow egg; 3, a round one, and, though shorter, considerably heavier than 2; the proportions of 5 are much those of 2; of 4, much those of 3. As for the markings of 5, they are much larger or more blotchy than in 1, 2 or 3, and a redder or more chestnut-brown. The figures show the lengths, &c. in inches and "thirty-seconds" of inches.—*J. C. Atkinson; Danby, Grosmont, York, May,* 1859.

The Shower of Fishes.—Some remarks in the 'Zoologist' (Zool. 6541) seem to indicate the conviction that the "shower of fish" in the Aberdare Valley was simply a hoax. I think actual fact will nevertheless excuse the otherwise apparently unbecoming assumption in me, of opposing such high authority by a contrary opinion, for, from information obtained from many sources and very careful and minute inquiry, I am quite convinced that a great number of fish did actually descend with rain over a considerable tract of country. The specimens I obtained from three individuals, resident some distance from each other, were of two species, the common minnow and three-spined stickleback; the former most abundant and mostly very small, though some had attained their full size.—*Robert Drane; Cardiff, May* 18, 1859.

A Monster Pike.—The Rev. W. Barham, of Lolworth, Cambridgeshire, had the good fortune to land a jack weighing 26 pounds, and measuring from tip to tip 3 feet 7 inches, across 8¾ inches, in the River Ouze, near Swavesey, Cambridgeshire; this gentleman succeeded, after five hours, in landing his prize.—*S. P. Saville; Cambridge, May* 6, 1859.

The Toads in Clay.—To the notice, in the 'Zoologist' (Zool. 6537), of the occurrence of live toads underneath a bed of clay, a note is subjoined by the Editor, asking the name of any scientific man who was present at the exhumation. I am unable to give such a name, further than as the intelligent foreman of the brickyard, Thomas Duddridge (who witnessed the exhumation by one of the labourers of the yard), may be entitled to the appellation; but no one, however high his scientific attainments, could be more careful than he was to give me correct information, or more exact in his statements; and if, after minute inquiry, I had not been fully satisfied of the correctness of his account, I should not have sought to occupy the page of the 'Zoologist' with its recital. On showing him the notice in the 'Zoologist,' he said it was impossible for anything to be more correct; and he added that the little cavity which the toads occupied was quite smooth in every part, apparently by their long-continued movements,—as smooth, to use his own illustration, as the inside of a china bowl.—*Thomas Clark; Halesleigh, May* 10, 1858.

The Edible Frog long a Native of Foulmire Fens. — In reply to Mr. Alfred Newton's query, in the last number of the 'Zoologist,' I have to remark that the fact of the esculent frog being indigenous to this country appears to me to rest on irrefragable testimony. My father, who was a native of Cambridgeshire, has often described to me, as long ago as I can recollect, the peculiarly loud and somewhat musical sound uttered by the frogs of Whaddon and Foulmire, which procured for them the name of 'Whaddon Organs." My father was always of opinion that they were of a different species from the common frog, and this opinion of his, formed nearly a century ago, was confirmed by Mr. Thurnall's discovery that the frogs of Foulmire are of the species Rana esculenta.—*Thomas Bell; Broad Street, May* 1, 1859.

On Squilla Desmarestii. By P. H. Gosse, Esq., F.R.S.

For the last six weeks I have had a living specimen of that pretty and rare Crustacean, Squilla Desmarestii (*Risso*). It was taken by means of the dredge from deep water, off Torquay, about the middle of April, and has lived in one of my aquariums until yesterday morning, when I found it dead.

This individual agreed accurately with Professor Bell's diagnosis (Brit. St.-Eyed Crust. 354) and figure. It measured, from the front of the eyes to the spines of the last abdominal segment, exactly two inches. Its colour while alive was a pellucid white, freckled all over with wood-brown or pale sepia; these frecklings or cloudings under a lens resolved themselves into groups (constellations, so to speak), more or less dense and more or less extensive, of very minute stars; the whole bearing a close resemblance to the colouring of Crangon vulgaris. The hands were white (ivory-like, but scarcely so opaque) without freckles. The yellowish hue (a warm buff) of the body, and the rose-tint of the edge of the hand and of some other parts, which Mr. Bell mentions, appeared only after immersion in alcohol.

Though this animal lived so long with me, and was manifestly in health, — for I have a strong suspicion that it died, at last, not of disease, but of the sly pinch of a wicked Gonoplax angulata, that for a much longer time has tenanted the same tank, — I have less to record concerning its habits than I hoped to learn when I first rejoiced in the possession of so great a prize. The mere acquisition of a preserved specimen seems to me a very poor object of ambition; when I get hold of a rarity it is with the hope of adding something to its Natural History.

The tank in which my Squilla resided is large, long-established, well-peopled, and furnished with abundant means of retirement. Of these last it availed itself to such an extent that, for many days at a time, I could not with the strictest search find it. Always inert and sluggish, it was yet much more active by night than by day. It never manifested the slightest disposition to burrow, but a favourite position was stretched upon the gravel, between two pieces of rock just sufficiently wide apart to allow it freedom. It had one most singular action, which it so frequently repeated as to be quite characteristic. When annoyed by being touched with a stick, it would suddenly bend its tail forward under the body, and throw a complete somersault, relapsing immediately into stillness again. The action was performed with the most beautiful litheness and ease, and in the smallest possible space, reminding me strongly of the feat of a professed tumbler. The perfect flexibility of the long depressed body was thus well displayed.

I fed it occasionally with small fragments of raw flesh, which it seized and held with its foot-jaws, but without any special manifestation of eagerness, and without bringing into operation (as I had hoped) those sabre-like weapons with which it is armed. I wished much to see the action of these, but was disappointed. I observed that they were always carried in a different position from that figured by Mr. Bell, in both S. Mantis and S. Desmarestii, though I perceive that the limbs are capable of being put into the position depicted. The terminal blade-like joint I always saw closed upon the haft-like penult, and the united weapon was so carried that the opening of the former would have been perpendicularly downwards, so that the stroke or sabre-like cut which the blade makes would seem to be an upward cut, contrary to what I had imagined. Yet, as I never saw the animal take a living prey, it may be that, when engaged in active warfare, the arm is so far erected that the stroke of the blade shall be horizontally inward, as represented.

On one or two occasions, indeed, I saw it show fight with these weapons. When I teased it with a long rod of wood, bringing the annoyance close to its head, it would suddenly throw forward its two arms together, and strike the stick with them. But with such lightning-like rapidity was the double blow given, that the eye could not determine with accuracy the relative positions of the parts. It certainly appeared to me, however, that it was a perpendicular upward stroke, and not a lateral one. The great force employed was shown by these two facts,—that the vibration of the blow was distinctly felt by my fingers that held the rod, and the clicking sound produced by the contact was plainly audible through a foot of water.

The eyes did not reflect the light of a candle in a concentrated glare, as do those of the prawn, and (in a less degree) those of some crabs; and I saw no trace of luminosity from any part of the body.

It ordinarily carried the body fully extended; never swam, so far as I saw, but was always on the ground.

P. H. GOSSE.

Torquay, May 2, 1859.

The Crab and its Allies.

By C. SPENCE BATE, Esq., F.L.S., &c.

THE sun was burning in the sky, the air was teeming full of heat; the horizon was shut out from view by the hot mist which steamed up from the surface of the earth and sea. All Nature seemed at rest, and basking in enjoyment; not a breath of air beyond the occasional "catspaw" that slowly glided along the surface of the sea, and as it swept our boat fluttered the small flag at the mast-head, and passed on in its waving course.

It was on such a morning as this, early in the beautiful and merry month of May, that, being in a yacht and drifting with the tide, we steered our path across the Plymouth Sound. Our course was slow; to gain advantage of the opportunity we threw overboard a towing-net, and let it drift astern for some half-hour, and then hauled it in. There is an interest in the hunt; the searching after little things that are trapped in the small meshes of the gauze.

To the unaccustomed eye the net often comes up empty, whereas to one who knows how to search there will be seen little patches of unshapen substances here and there. Several of these were in the net the first time we drew it in; these were carefully transferred to a tumbler full of clear sea-water collected to receive them. Scarcely had the seemingly shapeless masses been placed in the small prison than they dashed away in the full gambol of life's enjoyment, and exhibited several forms that were formerly known to naturalists by the name of Zöe. These were at one time thought to be mature animals, adults of their kind, and described and named as such; but a zealous and close-observing naturalist, in this same month, a few years ago, on his homeward course, after an unsuccessful day of search, entangled a solitary specimen: he took it home, and carefully tended his new acquaintance, supplied it with food and fresh water, and daily watched its habits; but all his care could not reproduce in the little prison the conditions of the free and open ocean, and the poor thing, after a few days, died. Had it been a starling or a man, we should say the poor thing pined because it could "not get out;" as it was but a Zöe, we think it had no sorrow or joy, no knowledge of the freedom it had lost, no hope to desire its removal; yet the free-swimming Zöe, that outlives the lashing of the surges of the storm, that skims the surface of the water when warm with the sun's rays, will not outlive a week of the greatest care the naturalist can bestow upon it in confinement.

Mr. Thomson's Zöe died within a week, but in dying told its history. The Zöe was but a young crab. Here was a discovery: it startled men of science all over the Continent. In Germany Rathke took up the challenge, and traced the history of the development of the Crustacea, as found in the freshwater crayfish (*Astacus fluviatilis*), and declared that Thomson was wrong. The Academy of Paris requested a deputation to investigate the subject, and sent MM. Audouin and Milne-Edwards to the Island of Rhé, where they remained some time in search of the truth, and declared that Mr. Thomson was wrong. In our own country the discovery was not left to pass unquestioned: Mr. Westwood investigated the so-called metamorphosis in the development of the land-crabs of Jamaica, and Dr. Kirby, in his 'Bridgewater Treatise,' refused to admit the correctness of Mr. Thomson's observation. But while all these investigators were at work, Mr. Thomson was still pursuing his course of observations, and found that another genus of Crustacea, that which Dr. Leach had named Megalopa, was also a young form of the common crab, and singularly enough the same volume of the 'Philosophical Transactions' which contains Mr. Westwood's refutation of the possibility of the Zöe being the young of a crab contains also Mr. Thomson's discovery that the Zöe is the first stage and Megalopa the second, and both are the young of the same animal.

That which was received with so much caution is now a well-known fact, nor was the scepticism with which it was received devoid of advantage; it led to a more extended investigation of the subject, and it has since been proved that the Zöe form of larva belongs only to one order of marine Crustacea; those which are freshwater or land carry their young until they have arrived to a form closely approximating that of the parent. But the Zöe that we take in the open water has much altered, both in form and size, from that of the larva as it quits the egg of the parent. As we see them first they are scarcely a line in length, and closed up within a membrane that conforms to each member and confines every hair, as shown in fig. 1. This tunic is thrown off within a few hours, and then the animal assumes the grotesque form of the recognised Zöe; it has one horn upon its back, and another projecting forwards in front of the head: these were confined down within the previous tunic, but became extended as soon as they were freed. The tail also, instead of being truncated and short, terminates in two long styliform processes; these were previously contracted within themselves, similarly to the horns upon the back and head,—that is, folded as a telescope is drawn within itself. These extend when the tunic is thrown off. All the hairs are liberated, and the animal appears to have more control over its motions. Previously it appeared, when in the water, to progress spirally; its big head led the way, but the tail was curved beneath with little power of action, and thus steered the young creature round and round in the direction of its progress. But when the larva is liberated from the embryonic tunic it immediately increases in size, and exhibits a more energetic character; it advances with a jerking motion, and always swims towards the light, keeping near the surface of the water; probably in the free state this is the case only in fine weather; when storms prevail and the winds tear up the waters, they sink to rest in the quiet depths of the ocean, where most of them become the prey of fish and other hungry Carnivora. We say most of them, for we can hardly believe but that if all that were hatched were permitted to grow

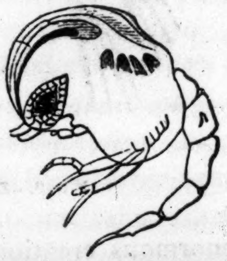

FIG. 1.—Zoe, as it appears when just free from the egg.

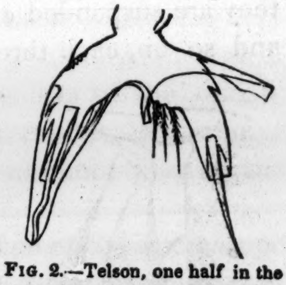

FIG. 2.—Telson, one half in the other partially freed from tunic.

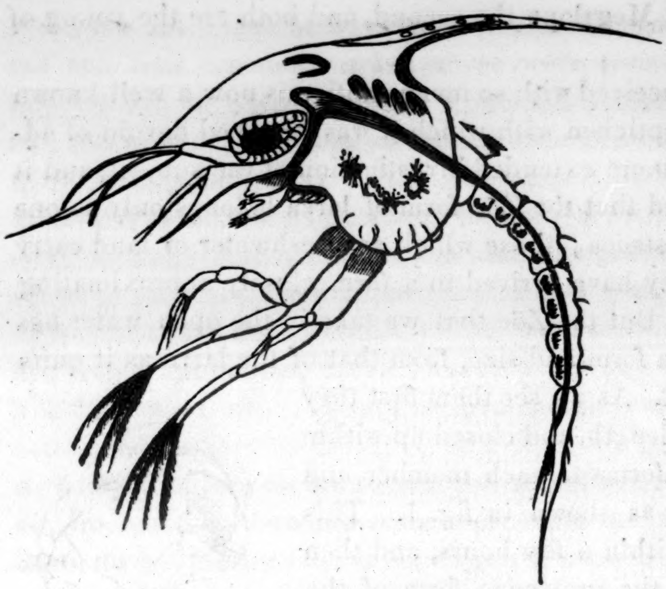

FIG. 3.—Zoe free from embryonic tunic.

to be adults, the seas would be swarming and running over with crabs, so great are the number born. Attached to a common edible crab, and that of very moderate dimensions, we calculated two millions of ova, and when we consider that they are capable and probably do have two or more broods in a year, we cannot but consider that the enormous creation of young animal life is designed as food to older and stronger creatures.

The egg is wrapped within a strong circular case, and this is attached to the parent, and carried by her beneath her tail, or curtain, or flap (the pleon). There is a mystery in the attachment of the ova to the parent: how they get there, and how they are attached we know not; they are suspended every one by a thread, and that thread to another, and so on, each thread suspending an ovum; thus, like a bunch of grapes, thousands hang in a mass, and each mass is suspended from the hairs which are attached to the swimming feet (*pleopoda*).

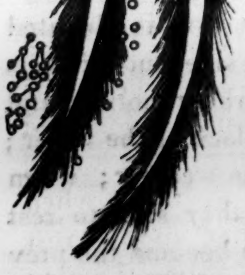

FIG. 4.—One of the pleopoda, or false feet, with a few ova attached.

These organs (the pleopoda) vary, in the female, from those of the male; in fact, they are mostly absent in the male crab (*Brachyura*), and are short, broad, double plates in the lobster (*Macroura*). In the female they consist each of two long appendages, the inner one straight, the outer slightly curved, and both fringed with hairs: it is the inner one to which the ova are suspended. When the egg is first deposited it probably is covered by gelatinous secretion, which forms the protection over each, and hardens into the thread by which it is suspended; but why they are suspended to the hairs upon the one branch and not upon the other is a question yet to be solved. For some few weeks the ova are carried about by the parent, during which time the embryo within developes itself and progresses in growth until it has arrived at the form which is known as the Zöe. By some instinctive consciousness, the parent now liberates the young from the ovisac: this it does by rupturing the outer case, sometimes by means of its feet, sometimes by pulling with its claws or nipper-formed hands. The young baby is thus early and unprotected cast upon its own resources in the wide world of waters, and soon no doubt large numbers fall a prey to hungry enemies; but a protecting Providence watches over a favoured remnant, which grow, and thrive, and people the ocean.

Within a few hours the young Zöe throws off its first tunic, or as a little child who saw an older specimen remarked, "pulls off its clothes;" this is repeated in the earlier period of existence, something about every week or ten days, but in confinement we have never been able to get it to pass beyond the second moult. We have taken them so frequently at different sizes that we think we are enabled to trace its growth with but a small, or perhaps no, hiatus in its history: with each moult the animal increases in size, then strengthens in its structure and developes its new growth, until it again throws off the exuviæ, and increases in dimensions; but with each progressive step a change of form is visible: when it is born it has but two or three swimming legs and a long tail; behind these swimming legs small sac-like appendages are apparent; these gradually increase in size, and become the strong claws and walking legs of the animal, while those which are first the swimming legs decrease in their relative importance, and fold themselves up as protecting and supplying organs of the mouth.

These things are small, and the close observation of the microscope is required to observe the facts. The growth of every part is progressive, and, curious to tell, all those members and appendages conspicuous in the young lose their importance and become either obsolete or of secondary value in the adult. In its youngest stage it is always swimming and knows no rest,—its paddle-like organs never cease in their vibration,—weeks pass away and there seems no wearying; but the time comes when, casting off the tunic once again, the soft and fleshy legs have progressed to a size sufficient to bear the weight of the animal; the skin then becomes impregnated with lime, and the structure sufficiently strong for use.

The animal now is changed; it is less a swimming creature, but when it does swim its organs of progression are not those of its younger days. In its first infancy the tail had no appendages; now it has five pairs of plates fringed with hairs; these are the small oars with which at this time it navigates its course in its occasional passages through the water; but its more congenial position is in some sheltered nook among the stones and weed at the bottom of the sea. Age is creeping on, so it puts off its youthful Zöe habits and assumes those becoming a grave and sober crab.

We said that in the hot and quiet days in early summer these young Crustacea may be found floating near the surface of the sea; but they know no rest,—they swim by night as well as day, for in the calm nights, when the air is warm and pleasant, the ocean shines with myriads of its own native stars. Break the surface with the dip of the oar, and it drops with a soft, sweet light, and every spark a living atom: among this resplendent glow the living Crustacea form no inconsiderable portion. Dip but a small quantity of the water, and carry home for observation, and small Entomostracan Crustacea in abundance, both living and dead, cast-off skins and broken limbs, testify to the number of the class that are present in the water.

The Zöe has ceased to be one,—it has lost its fantastic shape; the horn upon its back and brow are gone—lost in the greater development of the surrounding parts; the narrow sides of the animal swell out, the eyes are smaller and more in proportion, and the tail ceases to be forked. The creature has now become a Megalopa. This name was given by Dr. Leach to what he believed to be a new genus of Crustacea, which contained two species; but this genus as well as both species that it contains are now known to be but stages in the progressive growth of the same animal: the first of these that was found was taken by Colonel Montagu amongst corallines on the back of the prickly crab (*Maia Squinado*), on the southern coast of Devon, and named after the finder; the other, which is the younger form of the two, is called Megalopa armata, from the great spine upon its back; it was found in a crab-pot in Bigbury Bay, by Mr. C. Prideaux. Both of them are figured in Dr. Leach's work on the British crabs.

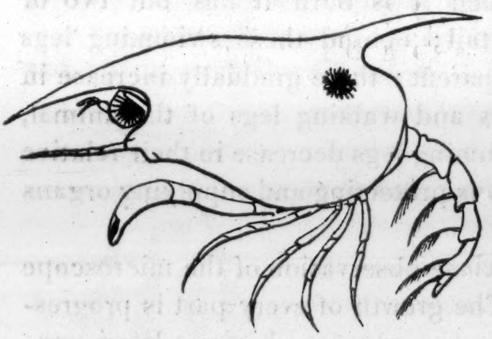

FIG. 5.—Young crab in the intermediate stage.

When Mr. Thomson first astonished naturalists, the wonder was created by the statement that the animals underwent a distinct metamorphosis,—that the Zöe changed to a Megalopa and the Megalopa became a crab, just in the same way that a caterpillar becomes a grub and the grub passes into a butterfly; and this idea has been taught by implication ever since in the most important works upon the subject. But observations upon many specimens taken at different ages have proved that these different stages are but mile-stones in the passage, and are arrived at by a series of progressive steps, each one scarcely appreciable from that which has preceded it.

Most young naturalists look for wonders: things that are astonishing are pleasing to the fancy. The Nautilus, when its history was dressed in the poet's fable, was a prettier thing than the poor cheat it has been found out to be. So with the crab, truth is not so pleasant as fiction, and there was something astonishing in these *insects* of the deep fulfilling in their history the conditions similar to their supposed analogues of the land.

Successive moults still bring the animal nearer to the form of the parent: the long projecting rostrum disappears, and the postorbital region, the position in which the liver is developed, increases in proportion, the tail is bent close beneath, and the animal assumes a square form; the continuing growth of the liver region increases the lateral dimensions of the crab, so that the adult is found broader than it is long. But all these alterations are slow, and without any sudden change, any metamorphosis, such as appears to exist in insects.*

The young crab is no longer a swimmer: those who wish to find it now must search the rocky pools upon the sea-shore, and turn the stones and weed, and seek beneath their sheltering protection, where, half-buried in the soil, it hides from the presence of its enemies, and watches for prey.

Although there is no sudden metamorphosis, there is a great change of form between the early larva and the adult Crustacea, and the same law of development appears to be persistent, as in animals of the higher types. The progressive growth of the creature passes through many stages, which have their types in adult forms: these would seem to suggest that each may be but an arrest in the development of the more perfect animal. The entomostracous form is that which it most resembles at first, both in its general appearance and in its movements and habits; with its growth it assimilates to those of a higher type, but passes not through all the inferior forms. The higher forms, such as the short-tailed crabs, skip over those of the stomapod type, and put on more early their own peculiar features, whereas the young of the Macroura, or long-tailed genera, enter more decidedly into the forms that are beneath them; and at a certain stage the larva of the prawn and shrimp can scarcely be detected from that of the adult opossum shrimp. Great outcries are made against those philosophers who endeavour to support the doctrines of the unity of animal creation; but there appears to us nothing outrageous in the idea that supposes the adult form which resembles the intermediate stage in the development of one of a higher type to have been the result of an arrest in the progress of that particular species. We know that an arrest in growth may take place under certain conditions for an indefinite length of time, and that during that period they even propogate their kind, but when those conditions are removed animals proceed to a higher degree of development, and complete the history of their lives. This has been shown to be true of the Tenoid worms, which remain unchanged and reproduce their own kind while inhabitants of one animal will, upon being devoured by another, pass on to the adult condition. If this be true for a period, we have only to suppose the conditions fixed, to make the arrest permanent, when it must take its place as a separate species among the rank of animals.

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* The development of the butterfly, &c. is quite as gradual, but it is hidden by the external forms of the caterpillar and grub.

In the development of the common shrimp, the progress of the animal is so nearly through the form of Mysis, that an arrest of development of the animal at that particular stage would place it in the genus. Now, whether the power to change the conditions, more or less favourable to the animal, or the actual creation of a new creature is the more consistent in the great plan of creation, there is at present not sufficient evidence for us to come to correct conclusions.

We know that altered circumstances induce a variety in form and size. The Crustacea that are large and spinous in the Arctic regions dwindle in dimensions and become less spinous in the temperate zones: these changes made constant appear the only separation between the variety and the species.

When the crab first becomes a walking animal, it bears no very distant resemblance to one of the triangular species, narrow in the front and broad towards the posterior extremity of the carapax. The spider-crabs, as they are nicknamed, from a general resemblance they are supposed to bear to a spider, have been placed as the highest forms in this class, but observation demonstrates that in the course of development, the Portunidæ assimilate in form very closely to the triangular group, and it appears but just that we should consider—if any adult form be passed in the production of a species — that that form must be less perfect than that at which the undeveloped creature finally arrives.

This seemingly fair inference appears to receive considerable force from a study of the habits of the animals. If we descend to the bottom of the sea, there amidst the tangled branches of the zoophytes, squatting beneath some stones or beside a mass of weed is the long-legged spider-crab. Here the lazy creature, with nothing of the habits of the active little being of the land whose name he has appropriated, sits and sits, and continues to sit on for weeks, perhaps months and years, without desire to change more than to snap up some bit of offal that has come as food to him. His great long legs seem to be misappropriated, and appear as stilts that raise him up so high that he is afraid to use them. Afraid, did I say ? — I mean he does not know how to use them ! Drive him from his lair where he has been so long that plants have taken root and grown upon his back; his limbs are a resting-place for sponges to fix themselves and thrive ; zoophytes spring up and look like trees ; and the calcareous coral takes its stony hold upon its back : amidst this forest the worm is seen to creep about the roots and take up its abode, and many other creatures fix upon the spot and think they have established their home upon a rock ; and here they dwell, and would bury this fakir of the ocean in their increasing growth, had not a fixed law in Nature come to his relief. He sheds his skin, and breaks at "one fell swoop" the hopes of all that rested on it. I said before, he knows not how to use his legs. And one is almost startled to think that in creation, so perfect in all its adaptations of the means to the end, that any organs should appear so useless to the possessor. The long sprawling members, generally incommoded by the attachment of weed, seem too long for use, and, to raise them over imperfect substances, they lift them up so high that it makes one almost think that once up they are never intended to come down again. Thus straddling on, he moves fearful of every thing he sees—timid, sluggish, and defenceless. The species fall a prey by hundreds to the ground-feeding fish.

Not so the depurators, the so-called cleansers of the ocean, under an assumption that they dine on decomposing offal,—but which is an error, for no marine animal is more particular in its feeding than the crab; I have seen them perish rather than devour tainted food.

Although, no doubt, they considerably assist in getting rid of animal refuse from the sea, yet it is all eaten by them before decomposition has commenced; and, therefore, the swimming crabs, no more than other species, have a right to be considered foul feeders. If among Crustacea such are to be found, they exist among the long-tailed genera (*Macroura*); the lobster and the shrimp with their near allies. The fisherman, if he wishes to catch a lobster, baits his trap with stinking meat, but when he hopes to take a crab, he always sets it with fresh; and we know upon the sea-shore that a drowned dog or cat is soon reduced to a skeleton under the devouring powers of a flock of shrimps. Those who wish to have a skeleton of a bird or other animal perfectly cleaned, will often thrust it into a nest of ants; but should they find it more convenient, they may procure the same results by mooring it in the sea where a number of shrimps are known to congregate. The knowledge of this fact was made available by the naturalists of the Arctic Expeditions; they placed specimens, of which they wished to have the skeletons preserved, beneath the ice, where they were rapidly reduced to that state by the myriads of small Crustacea living there.

These depurators, or swimming crabs, are active, lively creatures that seem conscious of existence, and endeavour to enjoy it to the full extent of their capability. They are called swimming crabs, because they manage to swim a little: they can, by a great deal of kicking with the legs, the two hind ones of which are flattened out to an oar-shape, progress in a diagonal line, but they must crawl up again, and this is called swimming. It puts me in mind of the flight of a young domestic goose, which through a hard day's labour has climbed to the top of a neighbouring hill, will, at sun-down, lift himself upon the wing and drop, to the astonishment of his old mother, in the valley below; but not to save his feathers could he perform the feat back again.

And at the bottom, the so-called swimming crab alights upon his feet, and then he feels at home: ever on his guard, watching, ready to run or quick to attack, as the case may require, to further his own protection; but it appears that where escape is impossible, and that an enemy is too powerful, the creature will fold his legs together and pretend that he is dead, trusting that where he expected no mercy when alive, he may at least find pity or neglect when dead. This trick is more common with the young edible crabs than any other; they will often throw themselves upon their backs and remain with their legs curled up and motionless for a considerable period, until they imagine the danger has passed away, and then, cautiously resuming their natural position, they steal slowly away to the nearest place of security.

The edible crab, when it has put on this trick, cannot be awakened out of it by any amount of annoyance. But the swimming crab, if touched, will soon throw off the cheat and run away, raising high and opening wide the two great biting-claws, and hasten to a place of safety, where once arrived it will bury itself in the soil beneath and permit only its dark back to appear on a level with the surface, that it may be overlooked, in its general resemblance to the half-buried stones upon the beach. But it is not asleep, no, nor like the foolish ostrich think that if it denies itself the power to see, that therefore it is safe; the eyes are raised and watchfully keep guard. In the common shrimps upon our shores this process of hiding is very prettily performed. In the little pools among the stones, where the shore is sandy, if you surprise a small shoal of these Crustacea, they spring with a simple flap of the tail to a considerable distance, where, resting upon the sand at the bottom of the pool, they gently disturb it with their feet and by their own gravity sink into the hollow; but when they have buried themselves to the level of the surface, they keep the sand upon their backs by the aid of the long filamentary extremities of the lower antennæ. These brush up, in small quantities at a time, the particles of sand; and when the labour is complete, I question if the sharpest eye could detect the spots where they lie concealed, unless they were seen to hide, and the black shining eyes and the antennæ alone be exposed. And there they lie at peace, secure in their concealment, let the danger continue ever so long. The slight jerking movement of the inner and the waving motion of the outer are all that tells of animal life beneath; and, since these are organs of hearing and smell, we may fairly infer that with the eyes they assist to watch and intimate when danger is near and the animal may securely come from its retreat.

But some are not so satisfied, and will not rest until they are considerably beneath the sand. This is the case with Portumnus variegatus, a pretty little shield-back mottled species of crab. Timid to excess, it almost lives beneath the sand, but this may arise partly from the circumstance of its habitat being between the tides, so that when the water has receded it buries itself to find moisture. At Swansea, where I have found them in considerable numbers, I had to dig for them with a trowel, but it was not difficult to find their resting-places; a little observation showed their track in the scratches that their feet had made, and where these ceased the animal was sure to be some six or ten inches below the surface. Another burrower is the masked crab (*Corystes Cassivilaunus*) so named from the imprint of the human face being distinctly marked upon its back. I took one once and kept it for some time to the amusement of many, so striking was the resemblance to the portraits of Mr. Pecksniff; and I only regretted that the animal already had received a name, and that I could not associate it with that eminent sneak.

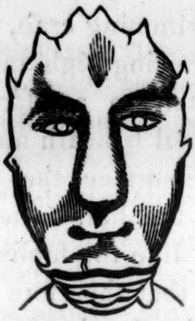

Fig. 6.—Carapace of the Masked Crab, to which eyes have been painted in.

These are active creatures, all of them, and much too nimble to allow weeds and animals to fix an abode and grow upon their surfaces. Then is it unreasonable for us to assume that, coupling their active character and general intelligence with the previously recognised statement that in their growth they pass through the triangular form, they stand as animals higher in their class than their more sluggish congeners, the spider-crabs. In the study of the lower forms we may make use of our own experience in the human temperament. The most perfectly developed nervous system is also the most active in its muscular action.

It is but just, since the triangular crabs have been recognised by the leading carcinologists as the highest of the class, that the reasons on which their opinions are based should be clearly understood, since they rest strictly upon anatomical evidence. It is on the fact of the consolidation of the nervous ganglia into a mass, and which, therefore, has been considered by carcinologists in general, and Professor Dana in particular, to be an increase of nervous power, and to approach the animal nearer to those which possess a true brain; to use his own words, "a centralization of the nervous ganglia is a true cephalization."

(To be continued.)

Remarkable Earth-worm.— I shall be very glad if some reader of the 'Zoologist' can assist me with information in the following matter. How many species of earthworm (*Lumbricus*) have we in Britain? and have we one species whose movements are exactly like those of a serpent? I am led to ask these questions from having seen in the fernery of a friend a remarkable worm, which, in outward appearance, differed little from the ordinary earth-worm, but whose motions were essentially different, being far more lively and serpentine in character. There was a slight steel-blue metallic colour about the anterior segments, but not more, I think, than in the ordinary worm. I may mention that it is quite possible that the worm in question may be a foreigner, for it was at first noticed in earth which came with some exotic ferns from Belgium. It has now become very plentiful in the fernery. Possibly I may be describing a species well known and common; if so, I must confess my ignorance, for I certainly never before noticed a worm with such lively and snake-like movements.—*George Norman; Hull, May* 9, 1859.

Description of the Larva of Eupithecia assimilata.—During the last two years I have paid considerable attention to the larvæ of the genus Eupithecia, and, through my own exertions and the kindness of friends, I have become acquainted with between twenty and thirty species of many of these. I have taken descriptions, and, as the Eupithecia family is one with which the majority of entomologists are but little acquainted, I propose each month, as I may be able, to give an accurate description of some one species. Having, in each instance, kept the larva separate and bred the perfect insect, I can speak with a certainty. My friend, Mr. Greene, having mentioned my name in connexion with E assimilata (Zool. 6542), I will begin with that species. Last October, 1858, I happened to be staying here with my father, and the thought struck me that there was no reason why E. assimilata should not be a Derbyshire insect. I had never seen the larva, but had heard that it fed on black currant, so out I turned into the kitchen-garden and set to work among the bushes; I had not been there more than half an hour when the dinner-bell rang, but I had bagged sixteen, which number in two days was increased to nearly forty. The majority of these, however, were, as usual, ichneumoned. The larva is slender and tapering slightly towards the head, and about three-quarters of an inch in length. The ground-colour yellowish green. Segments of rings yellow; the central dorsal line dark green; the two side ones of the same colour, but very indistinct; these latter studded, in some instances, at intervals with black dots. The whole body thickly sprinkled with small yellowish green tubercles, and very sparingly strewed with short whitish hairs. It strongly resembles a young larva of E. cervinaria. It turns pinkish when ready to spin up. The pupa is greenish brown, and enclosed in an earthern cocoon. The larva feeds, towards the middle of October, on the under side of the leaves of the black currant; mine were taken October 13—15. I am inclined to think it is double-brooded. It eats oblong holes in the leaves, by which its presence may be generally detected. In repose it mostly lies along the mid-rib of the leaf.—*H. Harpur Crewe; Breadsall Rectory, Derby, May* 6, 1859.

Entomological Puzzle.—In January last, while in Surrey, I noticed a fine Norway spruce that had apparently been blown down by the wind; the bole was snapped asunder about three feet from the ground. On a closer inspection, however, the wood at the place of the fracture was found mined in all directions by some wood-boring larva, probably a Sirex; thus the primary cause of the fall of the tree was evident.

But each of the bores contained one or two flies; these were, it seems, Sarcophaga carnaria, Musca vomitoria, Musca meridiana and Sargus cupreus: these flies were closely imbedded in the detritus of the wood. There were some hundreds so imbedded. Now the question arises, How did these flies become tenants of the bores? It is preposterous to suppose that they were "drawn into the bores by a spider, to be preyed on at leisure!" Why, when the juices were extracted, were the flies not ejected, as is usual under similar circumstances? Yet, strange to say, one of our leading entomologists favours such an idea, but of what genus and species the spider is, of course he cannot say! And so he leaves the matter. I am induced to ask you to insert these particulars in the pages of your serial, in the hope of eliciting a more satisfactory explanation. The bores were isolated, and apparently unconnected with one another, and in some instances they seemed to have no connection with the outer air.—*Peter Inchbald; Storthes Hall, Huddersfield, May* 17, 1859.—'*Intelligencer.*'

[Mr. Inchbald most obligingly sent me the specimens of perforated wood before he published the foregoing account: and be it known unto all men, that I am the "preposterous" entomologist who suggested that the borings were those of a Sirex larva, who gave Mr. Inchbald the names of the four flies, and who expressed the opinion that they were "drawn into the bores by a spider, to be preyed on at leisure." —*Edward Newman.*]

Dinarda Maërkelii and Hetærius sesquicornis.—Dr. Power headed a ravaging party to the Hogsback, near Guildford, on or about the birthday of Gracious Majesty: his myrmidons were S. Stevens, J. W. Douglas and E. Shepherd. Fifty D. Maërkelii were brought home. A few days previously fifteen beautiful specimens of Hetærius sesquicornis were taken at Hampstead by S. Stevens & Co. What is our friend Janson about? Here is a theme for his indignant pen!—*Ed. Zool.*

On the Transfer of Adamsia palliata from Shell to Shell.

By P. H. Gosse, Esq. F.R.S.

It has often been an interesting speculation with me,—In what manner is the due relation of size maintained between Adamsia palliata and its supporting shell, in the progressive growth of the former? We find, almost without exception, the Adamsia adhering around the mouth of an univalve shell, which is tenanted by the hermit crab (*Pagurus Prideauxii*). There is, moreover, a certain proportion of dimensions between the zoophyte and the shell; the young Adamsia occupying a small shell, such as that of a Littorina or Trochus, the full-grown individual a large one, such as that of a Natica or Buccinum. The crab is able to shift from a smaller to a larger shell when he needs enlarged accommodation, and since we know that his congener, P. Bernhardus does this habitually, we naturally conclude that such is the habit of P. Prideauxii.

Presuming then that this is the case, what becomes of the Adamsia? If the crab shifts his quarters and leaves the Adamsia behind, the association is broken, and we should certainly find Paguri without Adamsiæ, and Adamsiæ without Paguri. But we find neither the one nor the other.

On the other hand, if Adamsia is able to shift its quarters also, how does it proceed in its search for a new shell? If it forsakes the old tenement at the same time as the crab, and together with it takes possession of the new one, by what means is unity of will and action secured? What communication of thought takes place from the one to the other? As the Adamsia does not adhere to the crab, but to the shell, that is as they are independent of each other's movements, who takes the initiative? Who goes to seek the lodging? And at what point of the transaction does the other come in? All these questions I had mused on with interest; and at length have received some light towards their solution.

On the 10th of last January I obtained, by dredging in Torbay, a specimen of Adamsia palliata about half-grown, on a rather small shell of Natica monilifera, tenanted by a Pagurus Prideauxii, which seemed already too big for his habitation. Having put them into a well-established tank of large dimensions, the contents of which were in excellent condition, I succeeded in doing what I had never done before, domiciliating both crab and Adamsia. Both continued in the highest health, and became quite at home.

For about a fortnight last past, however, I have noticed that the Adamsia has not looked so well. One side or wing has gradually loosed its hold of the shell-lip, so that it hung loosely down beneath the breast of the crab. Yet in other respects the zoophyte seemed healthy. Latterly, too, the crab manifested symptoms of uncomfortable straitness, in the great extrusion of his fore-parts, so great, indeed, as to expose even the front of the soft abdomen. Yet I felt reluctant to present to the crab a larger shell, fearing that he would, in availing himself of it, desert his zoophyte friend, which would then die, and I should lose the specimen.

At length the desire to solve a problem in science prevailed over this feeling. A fact is better than a specimen. And so this morning (April 21st) I selected from my cabinet a full-grown Natica shell, and placed it on the tank-floor, not far from the disconsolate trio.

The Pagurus presently found the new shell, and immediately began to overhaul it. He did not do, however, as his brother Bernhard would have done, at once shift into the new house. Having turned it mouth upward, he took hold of the outer and inner lip each with a claw, and began to drag it about the tank. Occasionally he relinquished the hold of one claw, and probed the interior in the usual manner, and then resumed his march. I watched the proceeding for an hour or more, when, having other work to do, I left him alone.

The thought did occur to me,— Can this delay be intended to make the Adamsia cognizant of what is in contemplation, and to prepare it for the change? But I dismissed it as unlikely.

After about an hour's absence I returned to the examination. The Pagurus was comfortably lodged in his new abode, and the old one, which now looked small indeed, lay deserted at some little distance. I eagerly turned the latter over, to see what was the condition of Adamsia. Lo! no Adamsia was there; and the Pagurus, presently approaching the front of the tank, I saw, to my great gratification, that the old association was unbroken. There was the Adamsia, with one wing adhering to the lip of the new shell, and apparently the opposite wing also; but from the position of the group, this I could not be quite certain of. The situation of the zoophyte was quite normal,— the centre immediately below the breast of the crab, and in contact with the inner lip of the shell, while that wing which I could clearly see was creeping round upon the outer lip.

Examining now more closely the condition of things, with a lens, I saw that the central part of the Adamsia's base was adherent by a small point of its surface to the under thorax of the crab, between the bases of the legs.

Now this adhesion to the crab is a circumstance which, so far as I know, never takes place in the ordinary relations of the animals; and therefore I cannot but think it an extraordinary and temporary provision for the removal of the Adamsia from the old to the new shell, and for the correct adjustment of its position on the latter.

How then can we avoid the conclusion, that as soon as the crab had found the new shell to be suitable for exchange, the Adamsia also was made cognizant of the same fact; and that during the two hours which followed, the latter loosened its adhesion to the old shell, and, laying hold of the bosom of its protector, was by him carried to the new house, where immediately it began to secure the like hold to that which it had just relinquished?

But what a series of instincts does this series of facts open to us! The knowledge by the crab of the qualities of the new shell; the delay of his own satisfaction till his associate is ready; the power of communicating the fact to her; the power in her of apprehending the communication; her immediate obedience to the intimation; her relinquishment of her wonted hold, which for months at least had never been interrupted; her simultaneous taking of a new, unwonted hold where alone it could have been of any use; the concerted action of both; the removal; her relinquishment of the transitory adhesion as soon as its purpose was accomplished; her simultaneous grasp of the new shell in the proper places;—all these are wonderful to contemplate, wonderful considered singly, far more wonderful in their cumulation. Is there not here much more than what our modern physiologists are prone to call automatic movements, the results of reflex sensorial action? The more I study the lower animals, the more firmly am I persuaded of the existence in them of psychical faculties, such as consciousness, intelligence, will and choice! and that even in those forms in which as yet no nervous centres have been detected.

P. H. Gosse.

Torquay, April 21, 1859.

Additional notes on the above.

May 2. Eleven days have elapsed since the above observations were made, and I have now another interesting fact to record, bearing on this strange association. The Adamsia has not looked well since the change of residence; its adhesion to the shell has been but partial at the best, some days more, some days less, extensive; but for the most part a considerable portion of the zoophyte was hanging down from the shell. The crab, on the other hand, was evidently in clover, and showed no inclination to go back to his old lodging.

This morning I found the Adamsia detached, and lying helplessly on the bottom of the tank, beneath the crab, who, when disturbed, walked off, leaving his companion behind. I thought now it was a gone case, and that it was all up with my elegant protegée.

An hour or two afterwards, however, how great was my surprise to see the Adamsia fairly established again, adhering to the shell by a good broad base, and looking more healthy than I had seen her for many a day! Strangely enough, she was adhering in a false position, having taken hold on the outer lip of the shell, instead of the inner, as usual. Here was a fresh proof of intelligence somewhere; and I at once sat myself to find where.

Carefully taking up the shell with the aquarium tongs, and bringing it close to the surface, but not out of water, I gently dislodged the Adamsia with my fingers, and allowed it to fall prone to the bottom. I then released the shell and its tenant, and drove the latter towards the spot where the zoophyte lay.

No sooner did the crab touch the Adamsia than he took hold of it with his claws, first with one, then with both, and I saw in an instant what he was going to do. In the most orderly and expert manner he proceeded to apply the Adamsia to the shell. He found it lying base upward, and therefore the first thing was to turn it quite round. With the alternate grasps of the two pincers, nipping up the flesh of the Adamsia rudely enough, as it seemed, he got hold of it so that he could press the base against the proper part of the shell, — the inner lip. Then he remained quite still, holding it firmly appressed, for about ten minutes; at the end of which time he cautiously drew away first one claw, and then the other; and, beginning to walk away, I had the pleasure to see that the Adamsia was once more fairly adhering, and now in the right place.

May 4. The Adamsia is again lost. On searching I discovered it lying in a crevice, whence I plucked it, and laid it on the bottom. Here again the crab found it, and immediately went through the same process as last described, and again made it adhere. But I fear that the Adamsia is unhealthy, for it seems to have but an enfeebled power of retaining its hold. The manifestation of the mode in which the instinctive actings of the two creatures occur, is, however, I think sufficiently clear. The crab is certainly the more active promoter of the partnership: it is abundantly evident that he values the company of his elegant but very heterogeneous associate. These last observations have suggested a suspicion that the claws of the crab may have been employed in the transference of the cloaklet from shell to shell.

The subject is one which will abundantly repay further investigation; and I commend it to the notice of those zoologists who have access to the west coast of Scotland, where these animals appear to be most common.

8 JY 59

P. H. Gosse.

Torquay.

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